Producing Certification Teachers in Mathematics and Science: An Innovative Approach

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Introduction

School districts across the nation face shortages of teachers; the most critical areas include science and mathematics. The Mississippi teacher shortage is exacerbated by the large percentage of teachers eligible for retirement in the Delta. The "Educator Pipeline" Report indicates Mississippi's teachers are retiring or leaving the profession at a faster rate than new teachers are entering the state's classrooms (Russell, 1997). The most critical shortage areas include teachers of science and mathematics. Many districts use substitutes, teacher aids, and uncertified teachers to fill teaching positions. Interviews with administrators in the target districts indicate their needs are as follows: course work designed to remedy deficiencies in content, funds for taking exams and intervention strategies utilizing the analysis of successful and unsuccessful candidates. The major goal of the program includes the education of pre-service and in-service secondary teachers in knowledge and skills in mathematics and science content areas, pedagogical concepts, and the art and science of test taking. The goal will be accomplished by the following objectives:

1. Recruit and retain in-service teachers with undergraduate degrees in biology and mathematics and pre-service teachers in biology education and mathematics education.
2. Provide curriculum enrichment using NASA resources for in-service teachers.
3. Enhance the pre-service curriculum using teaching strategies and models such as inquiry, problem solving, critical thinking, and cooperative learning.

The program addresses the critical shortage of mathematics and science teachers in the Mississippi Delta by creating a workforce of local teaching talent, committed to remaining in the Delta area. This paper outlines the design, development and implementation of a model teacher preparation program. The project began as part of a three year grant in response to NASA's Minority University Mathematics, Science and Technology Awards for Teacher and Curriculum Enhancement Program (MASTAP) in Spring 1999. The program represents collaborative efforts between Mississippi Valley State University (MVSU), the National Aeronautics and Space Administration (NASA), and county school districts in federally designated rural empowerment zones and enterprise communities.

Under the grant with NASA, Mississippi Valley State University's Department of Mathematics, Computer and Information Sciences implemented a four week summer program and academic year Saturday workshops for pre-service and in-service teachers, including long-term substitutes and teacher aids from the Holmes,

Humphreys and Sunflower County School Districts. Participants engaged in activities designed to promote achievement of a passing score on national tests required for state certification. As a result, they gained knowledge and skills in the application of enhanced practices in mathematics and science content areas, pedagogical concepts, the Global Learning and Observations to Benefit the Environment (GLOBE) Program, and the art and science of test taking. The project's strength is the University's science education, mathematics education programs as well as seasoned educators from the surrounding school district. These combined efforts are geared towards the academic preparation of pre-service and in-service teachers, and from these efforts the project's name, NASA Teacher Prep Project, is derived. The project staff consisted of a GLOBE trainer and professors with diverse backgrounds in mathematics education, biology education, English, and physical science. A high school mathematics and biology instructor assisted the professors in teaching subject content in the program. In addition to teaching subject content, the staff advised and served as mentors to the pre-service and in-service teachers.

Recruiting and Applicant Selection

Science and mathematics students currently enrolled in the Department of Mathematics, Computer and Information Sciences and Natural Sciences and Environmental Health who wish to choose education as a profession are recruited for the program. Pre-service teachers are recruited by fliers posted across campus, personal contacts, faculty and media. Three biology education majors and two mathematics education majors represent the pre-service teachers. A basic requirement is a grade point average of 3.0 or higher and mandatory participation in program activities. Substitute teachers and/or aids, with majors in mathematics or science, who have not completed the official teacher certification process, are identified by school administrators to become a part of the program. Eleven long term substitute teachers – six in biology and five with a degree in mathematics - represent the in-service teachers.

All applicants must submit an application, copy of college/university transcript(s), two letters of recommendation and an essay on why they wish to participate in the program. Individuals with positive attitudes about teaching and education are accepted into the program as determined by a subjective evaluation of the writing sample in the essay. All participants are African American.

Project Implementation

The Teacher Prep Project involves four-weeks of instruction in the summer, six hours per day, Monday through Friday. A pre-workshop interview for all participants was conducted to assess the status of the teachers in regards to the Praxis and/or the specialty area tests. Various data were gathered on participants including dates of graduation, university affiliations, current and previous teaching assignments, and previous scores on the professional exam for educators. Customized questions were directed at each participant to assess test taking strategies, test anxiety, deficit/strength areas of content knowledge in biology and mathematics, and attitude(s) toward taking the Praxis test. Individualized responses were solicited concerning suggestions for optimal test preparation.

All participants were pre and post-tested. A survey of all participants reflected a need for better test taking skills, additional information in content areas, and strategies for minimizing stress. Learning Plus software was used as pre-test and post-test tool to assess knowledge in core academic skills (mathematics, reading and writing) in preparation for the Pre-Professional Skills Test (PPST). The Praxis Mathematics 0060 and Biology/General Science 0030 were used as pre and post test tools to assess improvements in subject content. Individualized, teacher profiles were developed addressing subject content areas of weakness of strength. Subject content areas were taught for two weeks, six hours each day. Math and biology/general science sessions ran concurrently during these weeks.

The teacher expository model of instruction, was the primary mode of instruction. Essentially, a math or scientific concept is explained and participants respond to directed questions. Participants received

individualized help as indicated by their needs. Group sessions, lectures, laboratory demonstrations, video cassettes, interactive computer based biology and mathematics software, journals and inquiry based instruction were utilized. Enrichment trips, experimental hands-on activities, intense study of topics, inquiry, and higher order thinking were also used to enhance instructions for participants. All learning activities were evaluated for student responsiveness to each learning activity.

Emphasis was also placed on inferencing-the ability to draw reasonable answers from graphs and schematas in topic areas where the knowledge base may be limited. Hands-on models were also constructed, as needed, to help participants strengthen their conceptual base.

The third week participants were introduced to selected GLOBE protocols and learning activities to reinforce subject content. All participants completed the GLOBE protocols and learning activities, including atmosphere, hydrology, and land cover/biology. The learning activities incorporated subject content on the specialty area tests such as earth science, ecology, biology of plants, and animals.

Participants traveled to the NASA Teacher Resource Center at the John C. Stennis Space Center to become familiar with the vast array of teaching materials available for educators. Participants also attended presentations by Aerospace Education Specialists.

All participants were post tested on the final day of the summer program. Pre and post test results went into individual portfolios. An item analysis provided an aggregate profile of incorrect answers and the instructional agenda for Saturday workshops consisting of a total of 30 hours following the summer program. In addition, participants were given one-on-one mentoring and tutoring in subject content areas by professors and assistants.

All participants received stipends in the program. In-service teachers interested in taking a class in a subject content area received tuition assistance and financial assistance in taking the national teachers test.

Results

Preliminary results to date seem to reveal that the one-on-one tutoring and interactive software are effective. A survey of the teachers revealed a consensus on the beneficial effects of immediate feedback on the learning curve. Participants also agree the pre and post tests are meaningful in assessing deficits/strengths in content areas. All participants (16) indicated that more preparation in test taking strategies would be advantageous. One (1) participant out of sixteen (16) indicated that studying relaxation techniques would be beneficial. Six (6) in-service teachers indicated that more content preparation was needed in microbiology and genetics. Two (2) pre-service teachers indicated a need for additional content preparation in mathematics especially linear algebra, number theory and probability.

Conclusion

Although each pre-service and in-service teacher who enters our program is unique - all have a common goal - state certification in mathematics or biology. The main intent of the project is to provide participants a chance to assemble in an informal, relaxed setting to receive one on one tutoring and mentoring. In particular, we hope to have participants
prepared to achieve a passing score on teacher examinations. The Teacher Prep Program is one attempt to increase the pool of state certified mathematics and science teachers in Mississippi.

Acknowledgment

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References

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